

CLAIMS

1. (Amended) A vibratory gyrosensor comprising a supporting substrate having a plurality of lands, and a vibration element mounted on a surface of the supporting substrate,

wherein the vibration element includes

a base portion provided with a plurality of terminals that are connected to the lands; and

a vibrator portion extending integrally from a side of the base portion in a cantilever manner, and

wherein the vibration element is mounted on the supporting substrate by joining the terminals to the lands with metallic projections disposed therebetween.

2. The vibratory gyrosensor according to Claim 1, wherein the metallic projections comprise gold bumps each provided on a corresponding one of the terminals, each gold bump being welded to the corresponding one of the lands.

3. The vibratory gyrosensor according to Claim 2, wherein each gold bump comprises multi-tiered bump components.

4. The vibratory gyrosensor according to Claim 1, wherein the mounting surface of the base portion is provided with a dummy bump.

5. (Amended) The vibratory gyrosensor according to Claim 1, wherein the vibrator portion is disposed at a lower level from a top surface of the base portion with a slope disposed

therebetween, and

wherein at least one of the metallic projections is disposed in a region corresponding to a region in which the slope is not provided.

6. The vibratory gyrosensor according to Claim 1, wherein the mounting surface of the base portion is provided with a groove which extends across a region between a base end of the vibrator portion and at least one of the terminals that is positioned proximate to the vibrator portion.

7. The vibratory gyrosensor according to Claim 6, wherein one end of the groove extends towards a side of the base portion.

8. The vibratory gyrosensor according to Claim 1, wherein the supporting substrate is provided with a recess in a region facing the substrate-facing surface of the vibrator portion, the recess providing a space in which the vibrator portion is allowed to vibrate freely in a thickness direction thereof.

9. The vibratory gyrosensor according to Claim 8, wherein the recess has a height that allows a displacement-damping rate of the vibrator portion to be maintained at a predetermined value against a damping effect of airflow produced in response to the vibration of the vibrator portion.

10. (Amended) The vibratory gyrosensor according to Claim

1, wherein the supporting substrate has a circuit element and a plurality of the vibration elements mounted thereon, the vibrator portions of the vibration elements being oriented in different axial directions from each other.

11. The vibratory gyrosensor according to Claim 10, wherein the circuit element comprises an IC component, the IC component being disposed in a main mounting region located in an intermediate section of a line that connects mounting regions of the plurality of vibration elements.

12. (Amended) A vibratory gyrosensor comprising a supporting substrate having a plurality of lands, and a vibration element mounted on a surface of the supporting substrate,

wherein the vibration element includes

a base portion provided with a plurality of terminals that are connected to the lands; and

a vibrator portion extending integrally from a side of the base portion in a cantilever manner, and

wherein the vibration element is mounted on the supporting substrate by joining the terminals to the lands with metallic projections disposed therebetween, and

wherein the supporting substrate is provided with a plurality of external connection terminals for electrically connecting the vibration element to an external control substrate.

13. (Amended) The vibratory gyrosensor according to Claim 12, wherein at least one of main surfaces of the supporting substrate is provided with a load buffering groove for buffering an external load.

14. The vibratory gyrosensor according to Claim 13, wherein the load buffering groove surrounds a mounting region of the vibration element.

15. The vibratory gyrosensor according to Claim 13, wherein the load buffering groove surrounds a mounting region of the circuit element.

16. The vibratory gyrosensor according to Claim 13, wherein the load buffering groove has a depth of 100 μm or more.

17. The vibratory gyrosensor according to Claim 12, wherein the vibration element is disposed closer to an outer periphery of the supporting substrate than to regions in which the external connection terminals are provided.

18. (Amended) The vibratory gyrosensor according to Claim 17, wherein the plurality of external connection terminals is arranged concyclically along a circle on a main surface of the supporting substrate, the circle defining a main region in which each external connection terminal is disposed.

19. (Amended) The vibratory gyrosensor according to Claim 12, wherein the plurality of external connection terminals

is arranged concyclically along a circle on a main surface of the supporting substrate, the circle defining a main region in which each external connection terminal is disposed, and wherein the vibration element is mounted in a region in which the external connection terminals arranged along the circle are not provided.

20. (Amended) The vibratory gyrosensor according to Claim 12, wherein the vibration element is covered with a light-shielding cover.

21. The vibratory gyrosensor according to Claim 12, wherein the external connection terminals and the control substrate have a load buffering layer disposed therebetween.

22. The vibratory gyrosensor according to Claim 21, wherein the load buffering layer comprises an anisotropic conductive film.

23. The vibratory gyrosensor according to Claim 21, wherein the load buffering layer comprises a flexible wiring substrate disposed between the external connection terminals and the control substrate.

24. (Added) The vibratory gyrosensor according to Claim 1, wherein the vibrator portion has a substrate-facing surface which is flush with a mounting surface of the base portion, the substrate-facing surface being provided with a first electrode layer, a piezoelectric layer stacked on the first electrode layer, and a second electrode layer stacked on the

piezoelectric layer.

25. (Added) The vibratory gyrosensor according to Claim 12, wherein the vibrator portion has a substrate-facing surface which is flush with a mounting surface of the base portion, the substrate-facing surface being provided with a first electrode layer, a piezoelectric layer stacked on the first electrode layer, and a second electrode layer stacked on the piezoelectric layer.